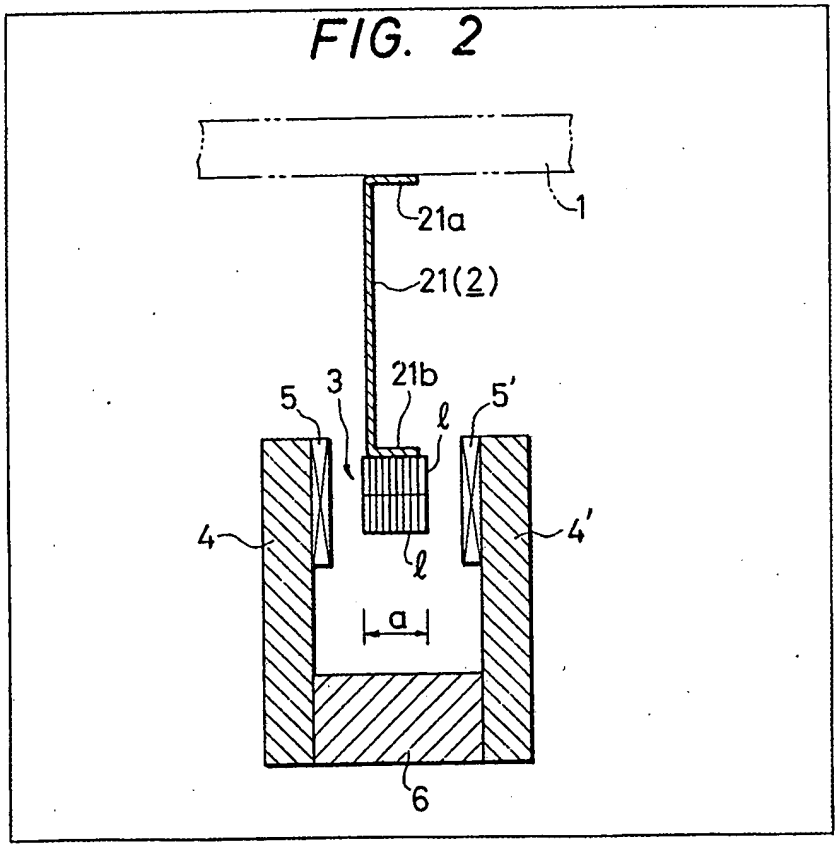
(12) UK Patent Application (19) GB (11) 2 055 014 A

(21) Application No 8021351
(22) Date of filing 30 Jun 1980
(30) Priority data
(31) 54/082955
(32) 30 Jun 1979
(33) Japan (JP)
(43) Application published
18 Feb 1981
(51) INT CL³
H04R 9/04
(52) Domestic classification
H4J 30F 31H EB
(56) Documents cited
GB 1478371
GB 1435555
GB 1035995
GB 623205
GB 439561
GB 383664
(58) Field of search
H4J
(71) Applicants
Pioneer Electronic Corporation, No. 4—1, Meguro 1-chome, Meguro-ku, Tokyo, Japan
(72) Inventors
Yukio Tsuchiya,
Kunihiko Shimada
(74) Agents
Marks & Clerk, Alpha Tower, ATV Centre, Birmingham B1 1TT

(54) Voice coil assembly for a loudspeaker employing a square planar diaphragm

(57) A square voice coil bobbin 2 has one end 21*a* thereof connected to a square planar diaphragm 1 of a loudspeaker, while the other end 21*b* thereof is coupled to a voice coil 3 disposed in the air gap between magnets 5 and 5′. The voice coil 3 is composed of at least two voice coil units I which are electrically connected together and mechanically stacked in the direction of movement of the voice coil 3 in the air gap. Each of the voice coil units I is formed by continuously laminating a tape-shaped electrical conductor in the widthwise direction of the air gap.

FIG. 2



GB 2 055 014 A

2055014

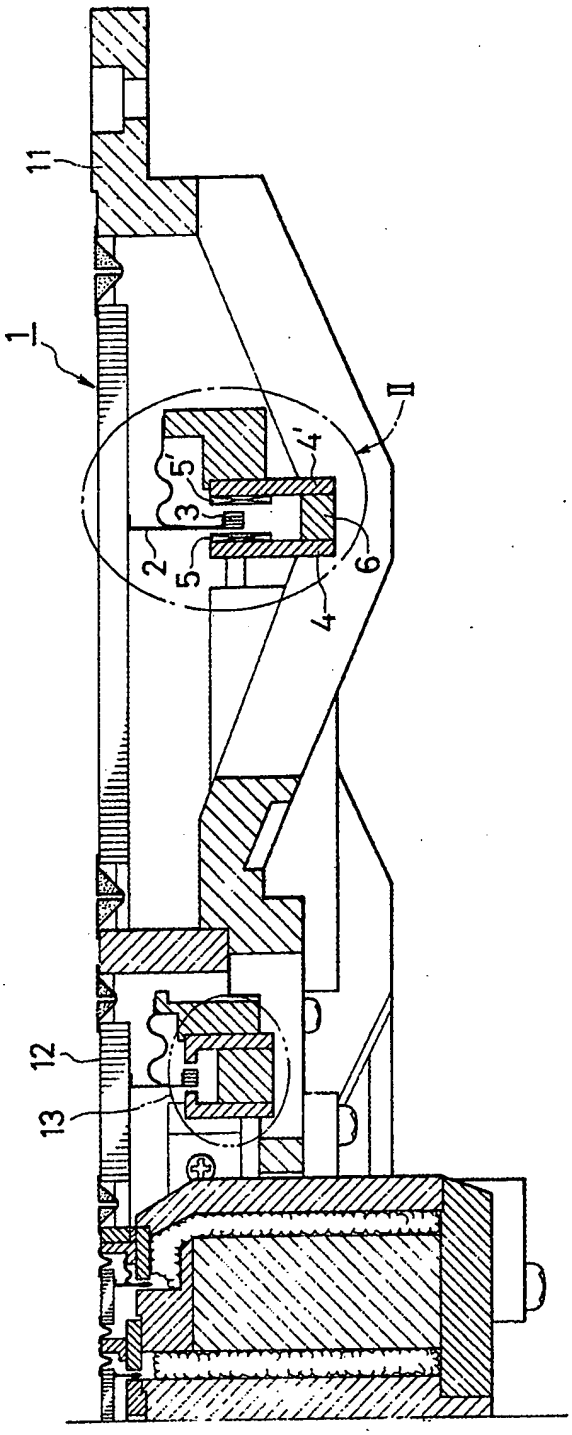


FIG. 1

2055014

FIG. 2

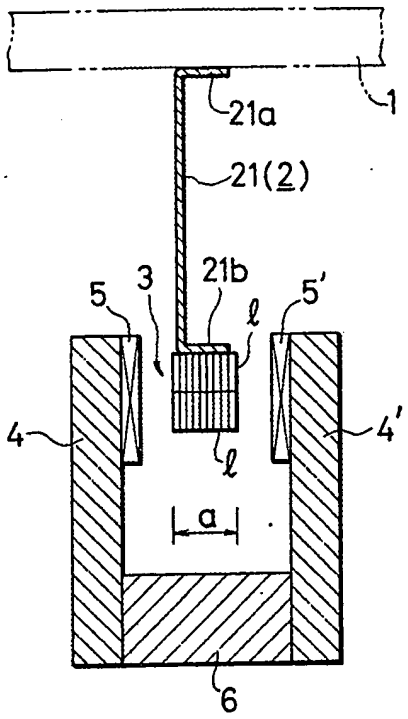
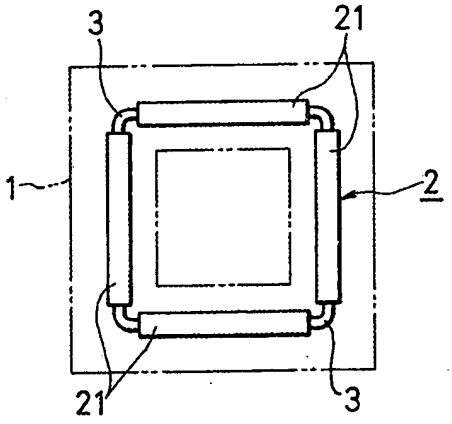


FIG. 3



SPECIFICATION

Voice coil assembly for a loudspeaker employing a square planar diaphragm

The present invention relates to a voice coil assembly for a loudspeaker employing a square planar diaphragm.

As is well known a planar diaphragm has excellent acoustic pressure characteristics with the acoustic image hardly moving during operation, and thus provides very high fidelity sound production. Accordingly, a variety of loudspeaker systems employing such planar diaphragms have been proposed. One of the advantages of a planar diaphragm type loudspeaker system is that its diameter can be increased readily. However, it should be noted that as the diameter is increased, the diameter of the driver unit must necessarily be correspondingly increased. Especially for a high power output, it is necessary to increase the length of the electrical conductor forming the voice coil. Accordingly, the lamination volume of the voice coil is considerably increased and hence the size of the air gap accommodating the bulky voice coil is also increased. If the air gap is increased, then the volume of the magnet must be also increased.

It is an object of the present invention to obviate or mitigate this disadvantage.

According to one aspect of the present invention, there is provided a voice coil assembly for a loudspeaker employing a square planar diaphragm, comprising a voice coil, a magnetic circuit for driving the voice coil, and a square coil bobbin to which the voice coil is coupled, the voice coil including at least two electrically connected, stacked voice coil units each of which is formed by continuously laminating a tape-shaped electrical conductor in the widthwise direction of an air gap of said magnetic circuit.

According to a second aspect of the present invention, there is provided a loudspeaker comprising a square planar diaphragm, a voice coil, a magnetic circuit for driving the voice coil, and a square voice coil bobbin having one end thereof connected to the diaphragm and the other end thereof coupled to the voice coil, the voice coil including at least two electrically connected, stacked voice coil units.

According to a third aspect of the invention, there is provided a loudspeaker comprising a square planar diaphragm, a square voice coil bobbin having one end thereof coupled to the diaphragm, a voice coil coupled to a second end of the voice coil bobbin and including at least two voice coil units electrically coupled together and stacked in the direction of motion of the voice coil, each of the voice coil units being formed by laminating a tape-shaped electrical conductor in the widthwise direction of the voice coil, and a magnetic circuit comprising first and second magnets of opposite magnetic polarity disposed opposite one another to form an air gap in which the voice coil is disposed.

An embodiment of the present invention will now be described, by way of example, with reference to the accompanying drawings, in which:—

Figure 1 is a cross-sectional view of part of a loudspeaker which includes a voice coil assembly according to the present invention;

Figure 2 is an enlarged view of the part of the loudspeaker indicated at II in Figure 1; and

Figure 3 is a front view of the voice coil assembly.

In the drawings, reference numeral 1 designates a square diaphragm which is formed by bonding a thin material to a honeycomb core. The diaphragm 1 is provided with a voice coil bobbin 2 which is formed by combining four bobbin frames 21 respectively parallel to the four sides of the square diaphragm. A first end portion 21*a* of each bobbin frame 21 is bonded to the diaphragm 1, while a second end portion or flange 21*b* thereof is fixedly bonded to a voice coil 3. The voice coil 3 is positioned in an air gap between magnets 5 and 5′ which are of different magnetic polarity and which are fixedly secured to the ends of plates 4 and 4′, respectively. The plates 4 and 4′ with the magnets 5 and 5′ are disposed on either side of a yoke 6.

In Figure 1, there are also shown a loudspeaker frame 11, a mid-range diaphragm 12, and a driver unit 13 for the mid-range diaphragm.

As can be seen in Figure 2, the voice coil 3 is made up of two voice coil units which are electrically connected together and stacked in the direction of motion of the voice coil 3. Each of the voice coil units is formed by laminating a tape-shaped or foil-shaped electrical conductor to a width *a* in the widthwise direction of the air gap. Because of its construction, the voice coil 3 is sufficiently long in the air gap and its driving force is great in proportion to its length, the length of the voice coil being increased compared with conventional arrangements. Accordingly, it is unnecessary to increase the air gap and the size of the magnets in providing the magnetic circuit.

As is clear from the above description, the voice coil assembly of the invention is so designed that the increase in volume of the voice coil associated with the increase in length thereof does not change the width of the voice coil in the air gap. Instead, the change of volume is effected in a direction perpendicular to the widthwise direction of the air gap. That is, the voice coil units are stacked in the direction of motion of the voice coil. Accordingly, the length of the voice coil is increased without increasing the air gap.

Reference is hereby directed to our co-pending UK patent applications listed below, which described other features of a loudspeaker system employing planar diaphragms:

U.K. Patent Application No. 8021353
U.K. Patent Application No. 8021354
U.K. Patent Application No. 8021352
U.K. Patent Application No. 8021350
U.K. Patent Application No. 8021349

CLAIMS

1. A voice coil assembly for a loudspeaker employing a square planar diaphragm, comprising a voice coil, a magnetic circuit for driving the voice coil, and a square voice coil bobbin to which the voice coil is coupled, the voice coil including at least two electrically connected, stacked voice coil units each of which is formed by continuously laminating a tape-shaped electrical conductor in the widthwise direction of an air gap of said magnetic circuit.

2. A loudspeaker comprising a square planar diaphragm, a voice coil, a magnetic circuit for driving the voice coil, and a square voice coil bobbin having one end thereof connected to the diaphragm and the other end thereof coupled to the voice coil, the voice coil including at least two electrically connected, stacked voice coil units.

3. A loudspeaker as claimed in Claim 2, wherein each of the voice coil units is formed by continuously laminating a tape-shaped electrical conductor in the widthwise direction of an air gap formed by the magnetic circuit.

4. A loudspeaker comprising a square planar diaphragm, a square voice coil bobbin having one end thereof coupled to the diaphragm, a voice coil coupled to a second end of the voice coil bobbin and including at least two voice coil units electrically coupled together and stacked in the direction of motion of the voice coil, each of the voice coil units being formed by laminating a tape-shaped electrical conductor in the widthwise direction of the voice coil, and a magnetic circuit comprising first and second magnets of opposite magnetic polarity disposed opposite one another to form an air gap in which the voice coil is disposed.

5. A voice coil assembly for a loudspeaker employing a square planar diaphragm, substantially as hereinbefore described with reference to the accompanying drawings.

Printed for Her Majesty's Stationery Office by the Courier Press, Leamington Spa, 1981. Published by the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.